(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 600 854 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **94200362.5**

(22) Date of filing: **06.08.93**

(51) Int. Cl.5: **B24B 45/00**, B27B 5/32, F16B 37/00, F16B 33/00, F16D 1/06

This application was filed on 11 - 02 - 1994 as a divisional application to the application mentioned under INID code 60.

(30) Priority: **31.08.92 JP 257419/92**

(43) Date of publication of application: **08.06.94 Bulletin 94/23**

(60) Publication number of the earlier application in accordance with Art.76 EPC: **0 588 483**

(84) Designated Contracting States: **DE FR GB IT**

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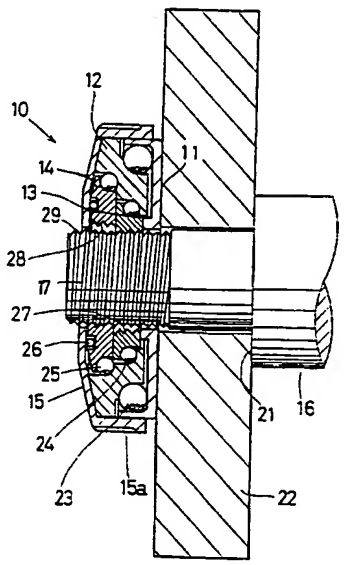
(54) Tightening screw.

(57) The tightening screw assembly (10) comprises screw members (13, 14) having a shaft core part with female threads (27, 28) formed thereon, a flange ring (11) fittedto the outer periphery of the screw members to contact with the object (22) to be tightened, an operating ring (15) for feeding a rotational force by fitting oppositely to the flange ring (11) on the outer periphery of the screw members, and a torque transmitting member in the form of a rotating ring (12) interspaced between the screw members (13, 14) and operating ring (15) for transmitting the rotational force of the operating ring to the screw members. The torque transmitting member comprises a reduction mechanism for transmitting the rotational force of the operating ring to the screw member by reducing the speed and increasing the torque. The female threads (27, 28) have the same pitch but a larger diameter than male threads (29) on a bolt (17) on which the object (22) is to be mounted. The female threads (27, 28) are eccentrically disposed relative to the male threads (29).

FIG.1



EP 0 600 854 A1

The invention relates to a tightening screw to be used as a tightening screw (for example, a nut) for tightening a rotary tool such as wheel of hand grinder and circular saw or hand saw to a mounting threaded part (for example, male threading) spirally provided in a drive shaft, being capable of tightening powerfully with a small rotary input and loosening, and regulating excessive tightening.

To mount a rotary tool such as grinding wheel and circular saw on a driving shaft, hitherto, a flange and male threads were formed at the end portion of the driving shaft, and the rotary tool was fitted to the male thread part, and a tightening screw with female threads such as a nut was fitted on its outer part, and by tightening the nut, the rotary tool between the nut and the flange was fixed.

In tightening and loosening operation of such nut, however, a power tool such as wrench was generally used, and therefore a sufficient amplification may not be obtained because only this power tool is used for amplifying the force to tighten or loosen the nut.

Besides, in the use of such rotary tool, if the rotary tool is used with an impact, the nut may be tightened more than desired by the impact and its reaction, and the nut is too tight when replacing the rotary tool, and it may not be removed by such power tool as wrench, and the nut cannot be removed unless the rotary tool is broken in an extreme case.

Purpose of the Invention

A tightening screw in which a rotating ring is rotatably held on a flange ring, a screw member having female threads in the same pitch as the male threads of the bolt to be fitted, with the female thread diameter formed larger than the male thread diameter, is rotatably held eccentrically so that some of female threads of the screw member may be engaged with the male threads preliminarily, and the flange is fixed at the time of tightening so that the rotating ring may revolve the screw member, and thereby the decelerated rotation created in the screw member produces a large tightening force to increase the torque.

It is a first object of the invention to present a tightening screw capable of obtaining a large tightening force or loosening force with a small rotary input, mounting the object securely, tightening or loosening directly by hand, without using power tool, because of the generation of a powerful rotational force increased in torque, and enhancing the attaching and detaching manipulation of the tightening screw.

It is a second object of the invention to present a tightening screw capable of attaching and detaching the tightening screw quickly without taking time in attaching and detaching because the rotary motion of the rotating ring or operating ring is directly the rotary motion of the screw member until the flange ring of the tightening screw abuts against the object to be tightened to fix the rotary motion.

It is a third object of the invention to present a tightening screw capable of preventing excessive tightening of the tightening screw during rotating job of the object to be tightened, by interspacing a flange ring for keeping a relative rotary motion between the revolving ring and the object to be tightened, so that the revolving ring may not rotate together with the object to be tightened.

It is a fourth object of the invention to present a tightening screw capable of distributing uniformly the uneven loads of screw members, rotating the tightening screw smoothly, and tightening with an effective increased torque, by disposing plural screw members uniformly on the circumference around the bolt to be tightened.

Brief Description of the Drawings

Fig. 1 is a sectional view of a tightening screw.

Fig. 2 is an exploded sectional view of the tightening screw.

Fig. 3 is an explanatory diagram showing an eccentric state of a nut ring.

Embodiment

An embodiment of the invention is described in detail below by reference to accompanying drawings.

The drawings show a tightening screw, and in Fig. 1 and Fig. 2, the tightening screw 10 is composed of a flange ring 11, a rotating ring 12, screw members of a first nut ring 13 and a second nut ring 14, and an operating ring, and in each central part of the flange ring 11, rotating ring 12 and operating ring 15, for example, insertion holes 18, 19, 20 are formed for inserting mounting bolts 17 of a drive shaft 16 of a power tool such as hand grinder. A flange 21 is formed on the drive shaft 16, and a rotary tool 11 to be tightened, for example, a wheel of a hand grinder is tightened and fixed between the flange 21 and the tightening screw 10 on the mounting bolts 17.

The rotating ring 12 is rotatably held in the flange ring 11 through a bearing 23, and the nut rings 13, 14 are rotatably held in the rotating ring 12 through bearings 24, 25, respectively, and the rotating ring 12 is press-fitted into the operating ring 15, and fixed in one body. On the outer periphery of the operating ring 15, a knurling 15a for rotating is formed. Numeral 26 is an O-ring for sealing the gap.

Female threads 27, 28 cut in the nut rings 13, 14 are formed in the same pitch as the male threads 29 of the mounting bolts 17, and the screw diameter of the female threads 27, 28 is greater than that of the male threads 29, and the nut rings 13, 14 are held in the rotating ring 12 by eccentricity so that each part of the female threads 27, 28 may be engaged with the male threads 29 of the mounting bolts 17. The relative eccentric positions of the first nut ring 13 and second nut ring 14 are spaced at an interval of 180 degrees so as to be equally distributed on the circumference of the center 29a of the mounting bolt 17 (male threads 29) as shown in Fig. 3. Meanwhile, Fig. 3 shows the effective diameters of the female threads 27, 28 and male threads 29, and 27a is the center of the female threads 27, 28a is the center of the female threads 28, and these centers 27a, 28a are remote from the center 29a of the male threads 29 by 180 degrees.

By using thus composed tightening screw 10, in order to mount the rotary tool 22 on the mounting bolts 17 of the drive shaft 16, the operating ring 15 of the tightening screw 10 is directly rotated by manual operation on the male threads 29 of the mounting bolts 17, and the female threads 27, 28 of the both nut rings 13, 14 are screwed in, and in this screwing operation, if the flange ring 11 does not contact with the rotary tool 22, the operating ring 15, flange ring 11, rotating ring 12, and both nuts 13, 14 are rotated together by the assembling load, and the tightening screw 10 is fed forward in threads by the engagement between the contact parts of the female threads 27, 28 of the both nut rings 13, 14 and the male threads 29 of the mounting bolt 17.

Successively, when the flange ring 11 abuts against the rotary tool 22, and its rotation is loaded to stop the rotation of the flange ring 11 by this load, the rotary input applied to the rotating ring 12 through the operating ring 15 is applied to both nut rings 13, 14, thereby putting these nut rings 13, 14 into rotation, and the nut rings 13, 14 make rolling motions so that the female threads 27, 28 roll on the periphery of the male threads 29 of the mounting bolt 17, while the nuts 13, 14 revolves by the rolling motion as the female threads 27, 28 are longer than the male threads 29 in peripheral length, and this revolution means slowdown of the screw pitch feed of the rotating ring 12, and therefore the torque increases in the nut rings 13, 14, and by the revolution of the increased torque, the nut rings 13, 14 are screwed to the mounting bolts 17, so that the rotary tool 22 may be tightened and fixed to the mounting bolt 17 with the tightening force of the increased torque.

Incidentally, when the two nut rings 13, 14 are uniformly disposed as shown above, the bias load with increased torque of the nut rings 13, 14 uniformly acts on the periphery of the mounting bolt 17, so that smooth tightening may be achieved.

The torque increase rate of the nut rings 13, 14 is greater as the screw diameter having the greater diameter of the female threads 27, 28 approaches the screw diameter of the male threads 29 having the smaller diameter of the mounting bolt 17, and becomes smaller as going apart. In other words, the torque increase rate is higher as the peripheral length of the female threads 27, 28 is closer to the peripheral length of the male threads 29.

When loosening the tightening screw, since the rotation is already blocked as the flange ring 11 hits against the object such as the rotary tool 22, the nut rings 13, 14 are in rotating state, and as the rotary operation of the rotating ring 12 in the loosening direction revolves the nut rings 13, 14, the nut rings 13, 14 are rotated in the loosening direction with the same increased torque force as above.

Consequently, as the nut rings 13, 14 are loosened, and the flange ring 11 is departed from the object such as the rotary too until this rotation is permitted, the entire tightening screw 10 rotates in one body, and the rotation of the rotating ring 12 becomes the rotation of the nut rings 13, 14, so that loosening may be quickened.

In this embodiment, two nut rings 13, 14 are used, but it is possible to composed by using only one, or three or more, and when composing of a plurality of nut rings, it is desired to distribute the engaging positions with the bolts to be tightened uniformly so as to apply uniform loads to the bolts to be tightened. In the embodiment, meanwhile, the tightening screw 10 is rotated by hand, but a wrench or other power tool may be also used. In this case, it is possible to tighten with a less effort.

Claims

1. A tightening screw (10) characterized by rotatably holding a rotary ring (12) for receiving a rotary input by penetrating through an insertion hole (18, 19, 20) of a bolt (17) to be tightened in the central part, in a flange ring (11) penetrating through the insertion hole of the bolt to be tightened in the central part, and rotatably holding a screw member (13, 14) with female threads (27, 28) of same pitch as male threads (29) of the bolt to be tightened, formed in the female thread diameter greater than the male thread diameter, in the rotating ring, at eccentricity, so that a part of female threads of the screw member may be engaged with male threads.

2. A tightening screw of claim 1, wherein plural screw members (13, 14) are disposed uniformly on the circumference centered about the bolt (17) to be tightened.

FIG.1

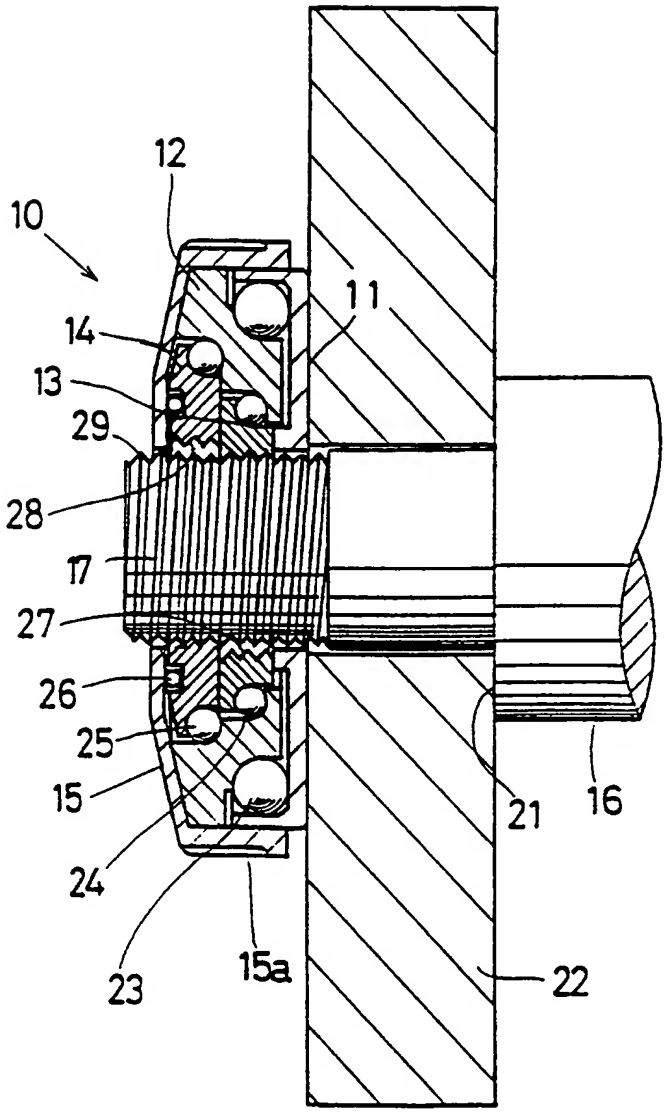


FIG. 2

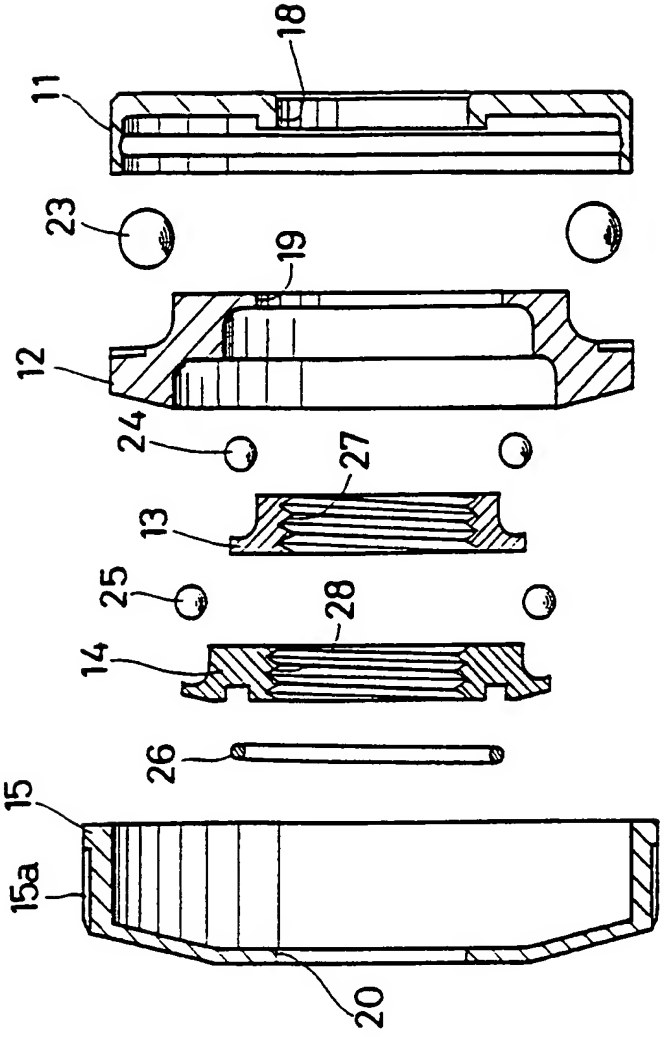
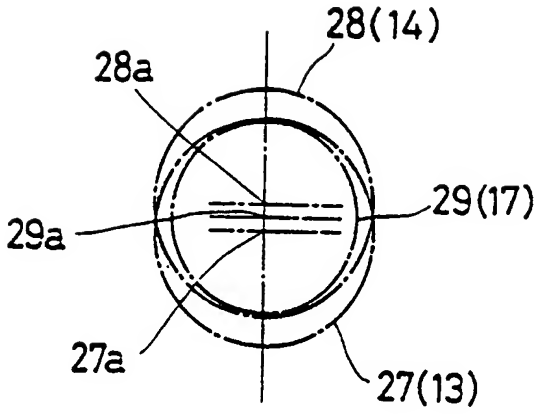


FIG. 3



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EUROPEAN SEARCH REPORT

Application Number
EP 94 20 0362

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
Y	WO-A-88 05386 (BOSCH) * the whole document * ---	1,2	B24B45/00 B27B5/32 F16B33/00
Y	EP-A-0 034 640 (GÄRTNER) * the whole document * -----	1,2	F16B37/00 F16D1/06

TECHNICAL FIELDS SEARCHED (Int.Cl.5)
B24B
B27B
F16B
F16D
F16H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	6 April 1994	Baldwin, D

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